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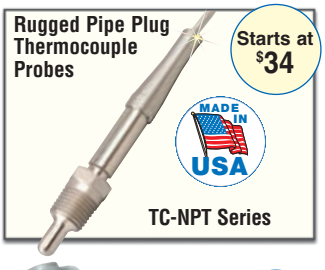

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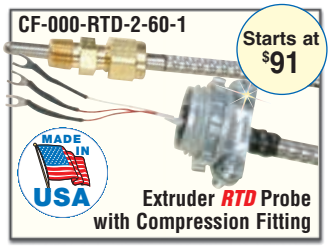

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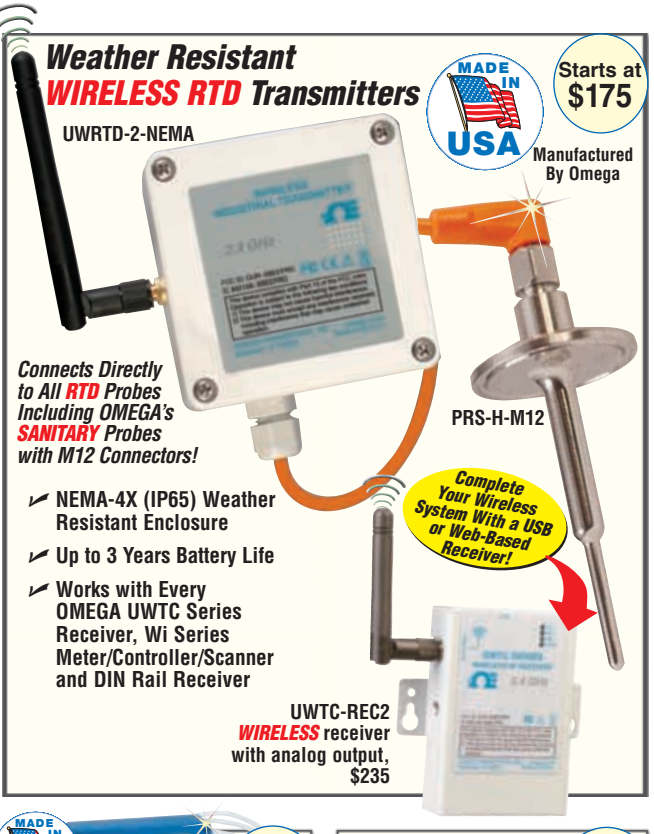

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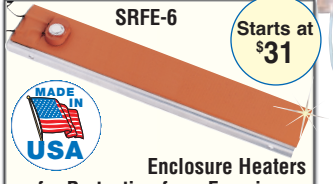

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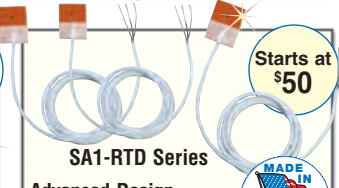

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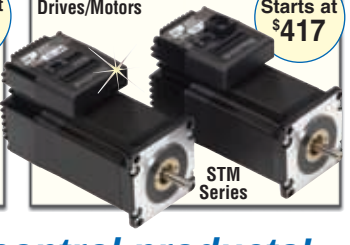

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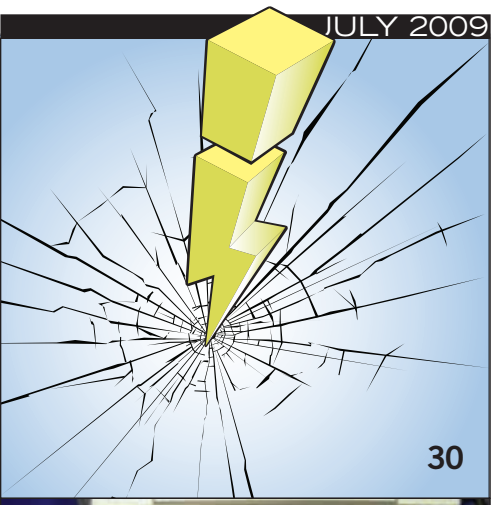

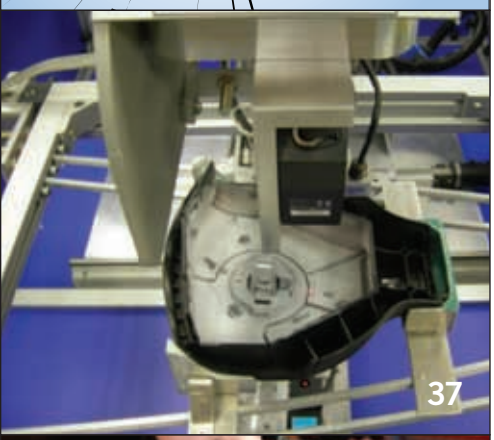

FEATURES

COLUMNS

HOT BUTTONS

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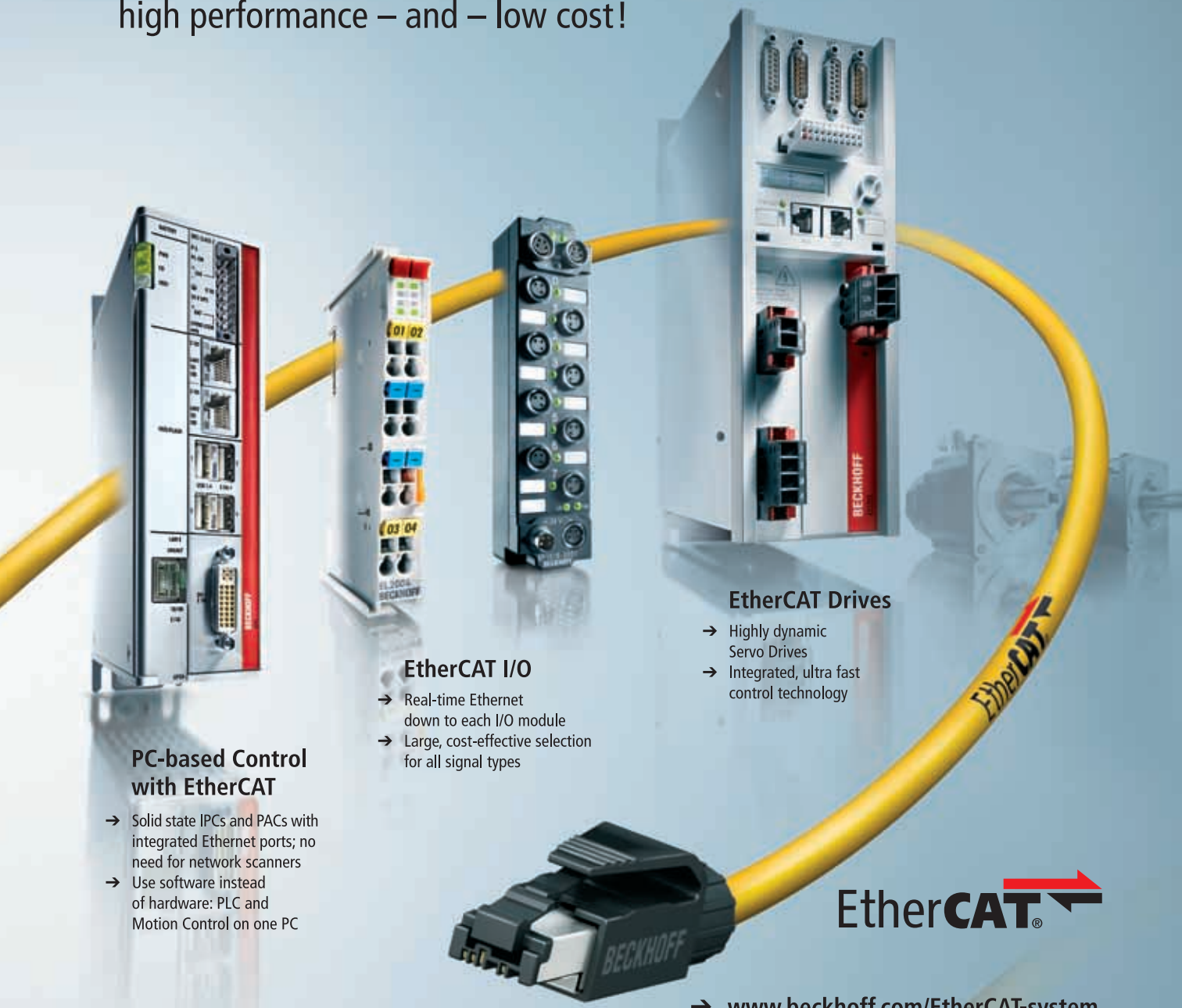

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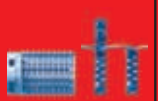
→ IPC	→ I/O	→ Motion	→ Automation
			

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Katherine Bonfante · managing editor, digital media · kbonfante@putman.net

Summer Releases

SUMMER IS HERE, and it's only natural for people to start planning things to do. Some of us might want to get a bit tan and choose the beach. Others might be interested in indoor activities. What's better than watching a movie, reading a good book or even a good news report?

Just like most Americans expect big movie releases from Hollywood, you, our loyal CONTROL DESIGN readers, expect big industry releases from us.

Well, expect no more. This summer, visit www.ControlDesign.com on a computer screen near you to watch, read and download our 2009 summer hits.

First, read our summer production snippets below and then visit our site. These industry releases are coming to you soon. Actually, they're available right now and at no cost.

Enhancing Power Transmission Reliability

Download Moxa's latest white paper to learn how EDS–510A managed Ethernet switches were used to ensure reliable and continuous power supply for one of the largest mass rapid transit systems in Japan, the Midosuji subway line in Osaka.

Get a copy of this paper at www.ControlDesign.com/moxapower.

Streamline the Machine Control Development Process

If you are looking for a way to reduce complications in designing machine control, this white paper from National Instruments is the answer you need. The traditional process for designing embedded machine control systems typically involves multiple stages of development, and each stage requires specialized electronic design automation tools.

Visit www.ControlDesign.com/ni-machinecontrol and download this white paper to learn about new, highly automated graphical system design (GSD) tools and PAC hardware systems that can help you streamline the machine control development process.

Market Intelligence Report: Programmable Controller Platforms

CONTROL DESIGN surveyed its audience to learn which programmable controller platforms they're using. We asked about the controls they prefer, whether they've switched recently, the scan times they need and the programming languages they use. This production stars John Lewis, vice president of engineering and construction at Fulghum Industries, with his insightful comments on the research results.

Watch the video at www.ControlDesign.com/controllersreport.

Making the Smart Grid Work

In order to bring down the cost of supplying power and reduce the carbon footprint of the power industry worldwide, many governments and industries have been moving the transmission and distribution of electricity to a new smart-grid model. This model is expected to produce a real–time responsive electric system from power generation to end consumers. In this white paper, Advantech discusses making the smart grid work.

This paper is available at www.ControlDesign.com/smartgrid. CD

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Engines & Turbines	1,746
Food Products Machinery	1,755
Industrial Fans, Blowers, & Air Purification Equipment	839
Industrial Heating, Refrigeration, & Air Conditioning Equipment	1,493
Industrial Process Furnaces & Ovens	589
Machine Tools	4,686
Materials Handling, Conveyors, Conveying Equipment	1,824
Metalworking Machinery	3,149
Mining Machinery & Equipment	562
Oil & Gas Field Machinery & Equipment	1,218
Packaging Machinery	799
Paper Industries Machinery	501
Printing Trades Machinery & Equipment	573
Pumps & Pumping Equipment	965
Rolling Mill Machinery & Equipment	152
Semiconductor Manufacturing Machinery	881
Textile Machinery	246
Woodworking Machinery	236
Other Industries & Special Industrial Machinery & Equipment NEC	12,709
TOTAL	**45,035**

BPA WORLDWIDE

Suddenly Impact?

I DON'T OFTEN write about subjects that stray from the issues that clearly impact on your machine automation roles.

This time, though, I want to pass along some data presented at Schneider Electric's Media Event last month regarding energy consumption. All of us have seen and heard troubling data on the subject. Much of the info just bounces off of our "I'm too busy to think about all this" protective shields.

Neil Rasmussen, senior vice president of innovation IT Business, displayed a slide of the Erlich Equation that for 35+ years has served to evaluate the environmental impact of the interaction of population, affluence and technology. I = P x A x T, with P = population, A = GDP/person, and T = lb of CO_2 emission/unit GDP. Plug in today's numbers—P=6.8 billion, A=$8K/person, and T=0.05 lb CO_2/$1K—and you arrive at an Impact (I) of 28 Gigatons of CO_2.

Then, presume no improvement in CO_2 emissions per GDP, set population in 2050 at 9 billion, affluence to $12K/person, and you'll find Impact at 54 Gigatons of CO_2.

That pushes atmospheric CO_2 levels above 450 ppm, raising temperatures and melting enough ice, reports the Intergovernmental Council on Climate Change (IPCC, www.ipcc.ch), to put NYC, southern Florida and most of coastal North Carolina underwater before 2100.

Unless you're counting on a population catastrophe or a plunge in world economic health, technology is the only way left to control CO_2. "That means cutting emissions from 54 Gigatons to 5 by 2050 to hold at 450 ppm CO_2," said Rasmussen. "Technology must de-carbonize by a factor of 10X."

Developing and commercializing sustainable energy sources is a critical variable in the outcome. Schneider's new pitch was about markedly improving energy use now, a way to make economical and early impact on the Impact. It says its businesses are involved in 72% of all end-user energy consumption, and it will offer a system approach to controlling the many energy-consumption issues confronting companies.

The message—to an editor who's seen a lot of automation suppliers repeatedly reorganize themselves, summon the press and declare war on [insert timely theme here]— felt substantial in its earnestness.

It seems there have been two drivers in energy management. Will it cut cost at an acceptable ROI? Can it help mitigate chronic, disruptive, energy supply and consumption

> **Much of the info bounces off of our "I'm too busy to think about all this" protective shields.**

problems? The results have been underwhelming thus far.

I got a hint—nothing really convincing, just a sense—from the various Schneider management members I listened to and spoke with that, maybe, there's a new generational driver now. An element in the decision-making process that's more hardwired to factor in global and societal imperatives to act, and to stake the reputation and success of its organization on it.

Now, that could have an impact with a capital I. cd

Joe Feeley

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PC Access Could Invite Hackers

MANY OEMS USE PCs for monitoring, control and remote access to their machines, robots and skids. As the price/performance ratio of PCs improves, applications become more widespread. But one major concern for many machine builders and their customers is holding PC implementation back, namely the lack of security inherent to most PC platforms when they are connected to the outside world.

PCs are cheap because tens of millions of units are sold each year, but this very ubiquity creates a security risk. The vast majority of hackers operate from a PC, usually Windows-based, and many of them know Windows and other popular PC operating systems such as Linux backward and forward.

The typical hacker might have trouble getting into your PLC or PAC, even if the controller was connected to the Internet via an Ethernet link. But odds are the same hacker could burrow into your Internet-connected PC with ease.

Fortunately, there are solutions. The first and simplest is to connect the PC to the outside world only at predefined periods when data exchange is required. "We can connect to a system anywhere in the world to remotely view the operator interface," says Keith Gardener, product engineering manager at MPI (www.mpi-systems.com) in Poughkeepsie, N.Y. MPI makes wax-injection-molding machines and automated pattern-assembly systems for the investment-casting industry.

"We establish a VPN connection to our customer's network, and then they control the connection," explains Gardener. "Our account usually is disabled and only activated by the customer when required. The VPN policies establish the limits of our access to the network. After a VPN is established, connection to each machine requires a separate login."

MoCo Engineering & Fabrication (www.mocoeng.com) in Spokane Valley, Wash., builds lumber-handling equipment, and it also implements remote access security via manual customer interaction.

"We offer a remote access option to our customers," notes Loren Wernecke, electrical and hydraulic manager. "It's a Web port device that uses open VPN tunnel technology, and the customer has to provide Internet access. Once the tunnel is created, MoCo can connect to any Ethernet device on the private side of the Web port as if they were on-site."

Placing the burden of remote-access security on the customer has many benefits. It allows a machine's PC to fit into the customer's security plan. To a large extent, it removes the OEM from security issues. It's also highly secure since a potential hacker normally would have only sporadic and relatively short time intervals to breach defenses.

But some customers would rather the machine builder be responsible for maintaining and establishing remote access connections—complete with required security. This saves the customer from manual intervention each time access is required and also lowers the level of required IT expertise on the customer's end.

In these types of applications, the OEM will have an always-on, secure link to its machine PC, preferably via the Internet to minimize costs. Ideally, this security will be implemented via a software add-on compatible with a wide range of operating systems and hardware platforms.

One way to do this is via a dual-operating system. In this approach, a highly secure and specialized operating system is installed on the PC between the hardware and the general-purpose operating system, which is usually some variant of Windows.

Placing the burden of remote-access security on the customer has many benefits. It allows a machine's PC to fit into the customer's security plan.

One company that supplies secure operating systems is Green Hills Software via its Padded Cell secure hypervisor. Padded Cell enables multiple guest operating systems such as Windows, Linux and Solaris and their applications to run in secure partitions on a single computer.

Green Hills calls this dual-operating-system approach a virtual machine. According to Green Hills, the use of its embedded operating system between Windows and the system hardware means there will be no software-related system failures and no susceptibility to viruses and worms.

The company also claims its operating-system technology is the first to undergo a high assurance (EAL 6+) Common Criteria security evaluation and gain EAL 6+ high robustness certification. Green Hills believes this security certification distinguishes its software from other virtual machine and hypervisor products. CD

Dan Hebert, PE · senior technical editor · dhebert@putman.net

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FOUNDED IN 1998 as a contract machine shop, Summit Machine (www.summitmachineinc.com) took less than a decade to expand its offerings and focus its growth by developing three divisions—custom automation, machine shop services and build-to-print contract manufacturing. "Summit Machine's principal areas of activities and business operations center around our core value of improving our customer's manufacturing processes through automation, design and build, integration services, CNC and manual machining and fabrication and welding," says president Todd Bauernfeind, who joined the Shoreview, Minn., company in 1999, soon after its inception.

Because of its evolving origins, Summit has practical experience in serving manufacturing customers from a variety of industries. "Our project and industry scope includes the high-precision assembly or component needs of medical and electronics products, as well as a variety of industrial and consumer products requiring manufacturing, testing, web converting, assembly and packaging," explains Bauernfeind. "The needs of the industries are all over the board from manufacturing cycle times, precision, cleanliness, robustness and sophistication of the automation or the machine to the more obvious concerns about budget and ROI."

Each solution Summit designs is tailored to the needs of the customer, which ultimately are driven by their processes and the demands of the industry. "We don't manufacture dedicated product lines," says Bauernfeind. "Instead, we engineer and fabricate custom solutions to manufacturing companies that have a need to implement, augment or improve their existing manufacturing processes."

Some of the technologies Summit and its 14 employees—including an electrical and a mechanical engineer—incorporates include process automation and assembly; sonic welding, spin welding and gluing; press assembly; conveying systems; RFID systems; print and apply labelers; and vibration, feeder and O-ring bowls.

Summit warrants its workmanship and machines for a year or more, depending on a risk level based on the technology, the capacity of the machine and the manufacturing environment. "We use SolidWorks for modeling and designing, so we have the ability to easily archive designs, drawings and parts for future modifications, spare parts or the customer's documentation," says Russ Hubrich, engineering manager. "Our machines typically include robotics, servos and PLC-based control, since we are producing one-off machines. This gives us the most flexibility, support and delivery."

The choice between hardwiring and digital networks depends largely on the size of the machine, explains Hubrich. "Typically small machines are hardwired and larger machines will use a network," he says. "Summit has implemented DeviceNet, ControlNet, EtherNet/IP and Profibus to distribute I/O across the machine. We always will use a digital network such as SERCOS for servo drives. This eliminates the added wiring and debug with analog systems."

Safety is an integral part of the design process at Summit. "Typically, risk assessments are performed to determine the level required," says Hubrich. "Each machine uses a safety relay as the base of the safety system, independent of the size. From there, larger machines will receive a more intelligent safety system to reduce installation time and debug in the future. Summit has used the Jokab Vital solution with great success on larger machines." CD

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Kevin Desrosier, assembly supervisor, hardwires an electrical panel for one of Summit's calendar machines.

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More Than Just a Rugged Face

ARE YOU STILL sitting on the fence (www.ControlDesign.com/pcplc)? Some controls engineers say they're moving to PC-based control, but harsh environments call for rugged components.

"PLCs are rugged, time-proven monsters of reliability," says Max Falcone, lead engineer on vision-aided tooling for Comau (www.comauinc.com), which develops complete turnkey systems for transportation and green-energy industry sectors. "That's why maintenance people and end users love PLCs, but unfortunately most require a fond understanding of ladder logic. The idea of a rugged PC isn't easily accepted because so many people tried putting standard desktop PCs in manufacturing environments, and they failed."

Rodney Price, senior electrical engineering specialist, Belvac Production Machinery (www.belvac.com), a beverage canmaker in Lynchburg, Va., sees ruggedness as a safety net for his applications. "We put our PC in A/C cabinets that are sealed from the environment," he explains. "So technically, a quality PC of any sort, even commercial, should perform very well. But moving from the world of PLCs, which are notably rugged, we feel safe in knowing that our PC can withstand the harshest environment that a hermetically sealed, air-conditioned control panel can dish out."

Any and all industrial applications are suitable for industrial PCs (IPCs), says Corey McAtee, product manager at Beckhoff Automation (www.beckhoffautomation.com/ipc). "Perhaps a more constructive way is to determine which applications are best-suited for specific processors," he says. "IPCs can automate machines that are involved in all forms of manufacturing. Small ARM-based processors running at 233 MHz up to Intel Core2 Duo at 2.16 GHz and beyond provide the perfect range to scale with great precision to unique control requirements and budgets."

Beckhoff supports Windows XP Pro, XP Embedded, Vista and Windows CE. "The deciding factor will be which hardware and software the system designer intends to use," explains McAtee. Windows CE has a large support base of users online who provide customization tips, he says.

Nematron's customers also push for more enterprise connectivity. "People are comfortable with Excel," says Ralph Damato , vice president—product management at Nematron (www.nematron.com). "When they're looking for process data to share, they can connect this to anything to analyze or sort."

Belvac uses PCs for database applications, machine control and HMI, adds Price. "We use a whole range of operating systems," he explains. "It depends on what we are doing with the controller. For simple machine control, we use Windows CE. For more integral things, such as manual on machines, we use Embedded XP. For my project, I'm running a custom HMI designed in InduSoft Web Studio with a ton of VB scripting and a Microsoft SQL 2008 database."

For Falcone, the PC means freedom. "We can program in any language we're comfortable with," he says. "For us, PC means flexibility. When you have a PLC system, you're tied into ladder logic. We're writing in Visual Basic or C++. The interface—Windows XP—is common and familiar to most people. The hardware options are plentiful, and you rarely get locked into proprietary licensing. You can make them your own and cater to your customer's needs. Sure, you can do this with a PLC, but it's a lot of work. The other advantage of a PC is true multitasking. This is huge for us in our RecogniSense product as we capture images, calculate positions and communicate to the robot all at the same time, taking advantage of the dual-core processor in the PC."

Windows CE has a large support base of users online who provide tips and tutorials for customization.

A huge area for advances with multi-core processors is to split the processor and tie each core to a major process, explains McAtee. "One core, for example, can manage CNC, one can manage I/O, and one can manage HMI," he says.

The panel for Comau's RecogniSense, a single-camera, six-degree-of-freedom recognition system used for robotic guidance, is designed around the PC to use its inner workings to keep the air inside the panel constantly moving, explains Falcone. "By mounting the PC higher in the panel and keeping the heat-generating components lower down, we use the fan and natural convection to cool the panel," he says. CD

Mike Bacidore · managing editor · mbacidore@putman.net

CPM for Discrete Industries to Grow 12%

THE MARKET FOR collaborative production management (CPM) for the discrete industries reached the billion-dollar mark in 2008 and will continue to grow despite the difficult economy, according to information from ARC Advisory Group (www.arcweb.com). With total software and services revenues of $1.083 billion in 2008, the five-year forecast is for a strong cumulative average growth rate (CAGR) of 12.3%. The market will grow to more than $1.9 billion by the end of 2013, according to ARC's new study.

Extreme competitive pressures are driving manufacturers to improve visibility, quality, customer responsiveness and regulatory compliance, says Greg Gorbach, vice president and principal author of the ARC report. With the increased volume of change, plant managers can't manage their plants in the same way. It's becoming increasingly obvious that manual methods are no longer viable, causing many to seek an IT systems solution, he says. Operating excellence and compliance, along with dynamic value creation, comprise opportunities for competitive advantage in manufacturing operations, adds Gorbach. The path to profitability in manufacturing is changing because of increasing costs for energy, water, waste generation, compliance and risk management, according to the report.

The ARC study assesses the CPM market and suggests a foundation for strategic planning through the year 2013. Production management solutions are designed to provide manufacturers with the means to plan, operate and control their manufacturing operations on an ongoing basis. They do this by providing functionality such as workflow planning and management, factory and manufacturing process modeling, recipe management, resource management, production optimization and tight integration with other applications.

CPM has three main areas of functionality that include planning, operating and informing. The planning segment consists of functions such as short-term production planning, plant simulation and modeling, electronic routing and finite capacity scheduling. This group of functions determines which products to make, when to make them and which equipment to use. The operating segment stems from the need to continuously control work processes, process equipment and operate the plant. This segment includes dispatching, electronic work instructions, resource management and workflow management. The informing segment stems from the need to gather, store, organize and communicate data and information.

MACHINE INVESTMENT

Students at a CNC training center in Ohio are learning machine programming and operation skills on a MAG VMC 4020 FX, courtesy of a local machine supplier. The Akron CNC Training Center offers a 17-week adult education program that teaches skills necessary to enter the machining job market. The school is located inside S.C. Manufacturing, and the CNC milling machine was provided through consignment from HM Technology of North Royalton, Ohio. David Grega (from left), president of HM Technology, Laurie Norval, training center director, and Steve Gaug, HM sales manager, are pictured.

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NACM Sees Improvement

The Credit Managers' Index (CMI) again showed upward movement in May. It began to climb in February, and now has carried gains forward in four consecutive months, according to the National Assn. of Credit Management (www.nacm.org).

The latest CMI combined index rose from 44.3 to 45.4, which equals levels not seen since October 2008 when the overall economy began its major slide. "The recession essentially came to an end in February and March of 2009," says Chris Kuehl, Ph.D., NACM economist. "The CMI data, combined with various other measures, suggest that the economy finally reached its lowest point and has been in the recovery stage since."

Kuehl says this doesn't mean the economy will come roaring back in the next few months but predicts the second quarter will be the last quarter of negative GDP as the third quarter should show some growth.

A great deal of regional and sector variation, which mirrors the performance of the U.S. economy as a whole, still exists. The states that have seen the highest rates of job loss and bankruptcy—California, Florida, Michigan and Ohio—are seeing the weakest performance in terms of credit. However, some states seeing severe declines—most notably Arizona and Nevada—have shown some improvement.

NOTEWORTHY

Moore Industries (www.miinet.com) received ISO 9001:2008 certification for its quality management system by UL DQS (www.ul-dqsusa.com), an ANSI-ASQ-accredited registrar.

TÜV Rheinland Indonesia (www.tuv.com/id/en) earned accreditation from the National Accreditation Committee (KAN) for issuing Indonesian national standard approval.

MAG Industrial Automation Systems (www.mag-ias.com) received the Caterpillar Supplier Quality Excellence Process Certification (SQEP), an award for commitment to zero defects.

Wonderware (www.wonderware.com) received Frost & Sullivan's (www.frost.com) Excellence in Customer Value of the Year award for the control software solutions and services category.

MERGERS, ALLIANCES & ACQUISITIONS

Intelligrated (www.intelligrated.com) purchased American operations from FKI Logistex Group, a material-handling systems provider.

Kepware Technologies (www.kepware.com) and **Iconics** (www.iconics.com) partnered to deliver a Windows CE communications solution for use with embedded SCADA and visualization products.

Brooks Instrument (www.brooksinstrument.com) acquired Celerity's instrumentation division.

Sick (www.sickusa.com) joined the **Profibus/Profinet Trade Assn.** (www.profibus.com).

The manufacturing sector continues to improve slowly, according to NACM. The most improvement tended to show up in the reduction of unfavorable factors, as favorable indicators basically were unchanged from the previous month's data. By most accounts the manufacturing sector is just now showing some positive movement, and it is possible that credit activity in the sector might have provided some advance warning.

In the months to come, more aggressive growth in the manufacturing sector will be likely as other data suggest that capital expenditures in the manufacturing arena are growing. And although the number of bankruptcies has increased over the past several months, the pace has slowed, according to NACM. CD

Students Win NBT Honors

Twenty-nine students seeking careers in manufacturing earned scholarships toward their college or trade school education from Nuts, Bolts & Thingamajigs (www.nutsandboltsfoundation.org) and SolidWorks (www.solidworks.com).

NBT, the foundation of the Fabricators & Manufacturers Assn., and SolidWorks awarded 11 traditional scholarships to college- or trade school-bound high-school seniors and college students seeking careers in manufacturing.

In addition, 18 students received $500 GO-Brennan scholarships based on a YouTube promotion tied to NBT's sponsorship of 16-year-old stock car driver and welder Brennan Palmiter.

To be eligible for the traditional scholarships, applicants were required to be full-time students with a minimum GPA enrolled in an engineering or manufacturing-related course of study, or a trade or technical program that may lead to a career in manufacturing.

Students were responsible for submitting academic records and an engineering or manufacturing-related program description.

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Every Grey Hair Has a Silver Lining

IN PAST COLUMNS I've written that unions might need to alter their fundamentals, that training is a huge tipping point for our futures and that loyalty and good will, sometimes built up over years, often no longer count.

In the past few weeks I've heard from colleagues who have lost their jobs, those who think they might and those who are scared to bits because the future is such an unknown.

I recalled a conversation I had with a fellow named Gene Kirkendoll in the late '80s. Gene was working on automatic tire-pressure sensors back then, a very cool idea that is widely prevalent in today's technology.

Tractor trailer tires fly off trucks and kill people. A warning that the air pressure was changing might have stopped that from happening. More importantly, additional technology would have been developed to measure the torque changes in the tire lugs.

Gene was in his 60s, had been laid off and was looking for a challenge. The software company I was working with at the time hired him to provide some "grey-hair" vision.

I wondered exactly what that was supposed to mean at the time.

Present day: My baseball-playing buddy and fellow stock-market tracker Marcel called me because of an issue with his wireless tablet running Windows XP. "My IT department downloaded a new patch right when I was entering my customer order," he fumed.

While it is cool to update applications by pushing the technology, there is no grey-hair component to this action.

Could they really be that dumb? Don't they know that people are actually working and need to have access?

So, the wireless connection fails, and users can't connect. After doing the daily entry manually, Marcel calls the support desk because the pushed application doesn't work.

Well, he finds out that the guy he normally would talk to has been laid off. "He was so good at this stuff," Marcel said. I asked how old he was. "Our age."

He speaks with one of the two support guys who are still left. The support guy is much younger than Marcel. "Yeah, we know there's an issue," is the reply. "We'll send instructions by email."

The next day the instructions arrive as promised. I intend no disrespect to Marcel, but he's not a computer whiz.

The instructions written by this support guy simply assumed everyone who read them would know what he meant. Not so. Most people don't even know what the Task Manager is, let alone how to stop a process.

I spent time with Marcel leading him through the process, grimacing most of the time because I couldn't believe that someone could produce such poorly considered instructions for this audience.

We got the wireless part working OK, but he couldn't connect his database. At this point he said, "To heck with it, it's Friday, and I'll deal with it on Monday."

I told him that it probably would work OK on Monday because of the server-side problems that probably exist.

Well, it now seems the company realized the error of its ways and tried to get the old fellow back into the fold. But go figure—he found another job. Good help is easy to lose and hard to find, the old saying goes.

> **Experience produces much innovation and efficiencies, but experience costs money. So, what happens when it is gone?**

In troubling and uncertain times we can react in ways that we shouldn't. We might be told to cut the budget, and the biggest numbers on the balance sheet, like salaries, get the attention.

Who do you think usually makes the most dough? Those grey hairs, of course.

Experience produces much innovation and efficiencies, but experience costs money. So, what happens when it is gone?

I mean no disrespect to the younger guys, but I am talking experience that allows for better decision-making processes in these times. You can't put an old head on young shoulders. CD

JEREMY POLLARD has been writing about technology and software issues for many years. Publisher of The Software User Online, he has been involved in control system programming and training for more than 25 years.

by Mike Bacidore, managing editor

Breakthrough 2009

This Year's Innovator Award Recipients Employ New Technology to Make a Difference for Their Customers

INNOVATION COMES IN waves and sometimes rips right through an industry. That's exactly what happened with the two winners of the 2009 CONTROL DESIGN Innovator Awards. Each is a game changer that brings an entirely new machine category to the industry it serves.

First, Control Logic (www.controllogic.com) was able to combine PC and PLC control and bring a modified version of its previous offerings to the lumber market.

Then, TGW-Ermanco (www.tgw-ermanco.com) used local logic to create a more-efficient and less-expensive distribution system solution.

RIP, Traditional Ripsaw: Control Logic's ValuRip Plus

When the majority of the furniture manufacturing industry moved to Asia, Control Logic faced the problem of retooling itself for an almost entirely different market. "We were left in the North American market with a completely different customer that couldn't afford the systems we'd been selling to those big furniture factories," says Chris Aiken, president of Control Logic in Hickory, N.C., and vice president of technology and service at its parent company, Weinig America (www.weiningusa.com), in Mooresville, N.C. "We were left with small moulding companies and cabinet shops. We started looking at our code base."

What Aiken found was that almost 30% of Control Logic's code base was being spent to connect the PC and PLC worlds. "We had to have OPC drivers and all of the hardware and separate programming software," he says. "We were doing the embedded platform for years, so we wanted that with the supportability of a PLC."

Where the Teeth Meet the Grain

"Lumber ripping" applies to the process of taking cuts of lumber from rough mills and ripping strips out of the wood at predetermined dimensions.

Lan McIlvain, operations manager at Alan McIlvain (www.alanmcilvain.com), one of the hardwood and custom moulding distributors Aiken describes, is using Control Logic's new solution, the ValuRip Plus, at his company's facility in Marcus Hook, Pa. "We used to have two ripsaws that were manual," he explains. "That's how 90% of the world does it."

Doing the shape detection and optimizing the board for cutting did not exist for a small cabinet manufacturer, explains Aiken. "They would measure the width at one point on the board and then would have to do manual overrides on every board," he says. "The first defect a board has is its shape. Most of the systems would measure the width of the board at one point. When you pull a board out of the drying process, you have a banana. Systems would measure the width of the board at one point and treat the board as a rectangle, so the operator would have to take a measurement."

CONTROL LOGIC

LASER RACK

Figure 1: Proper board scanning can reduce manual overrides by 10-15%.

CONTROL LOGIC

MEASURE TWICE

Figure 2: The ValuRip Plus measurement station gives an accurate two-dimensional measurement that translates into less waste.

If you can't scan the shape of the wood properly, you've got many loads of wood where the operator has to interact with 80-90% of the boards, says Aiken (Figure 1). If you scan the wood properly, you can reduce that to 10-15%, which frees up the operators to do other machine flow tasks, he says.

The ValuRip Plus completely eliminates the need for the saw operator to guess at the cuts he can get out of a board, which in turn reduces a great amount of waste, says McIlvain. "Since we installed the machinery we have seen at least a 5% increase in yield, we are able to process lumber twice as fast, and we have virtually eliminated human error (Figure 2). We have very high-end imported species of lumber. That ends up saving us even more money than we save in labor."

Before the ValuRip Plus, Alan McIlvain was using a manual gang ripaw run on two shifts and a straight line ripsaw run on one shift. "The same amount of work now gets done on one shift with only three employees versus a total of eight employees before," says McIlvain. "The same person is running the machine." He's monitoring the process and overrides the computer's decision when he sees a knot or certain other things, he says.

"Our next step is to pull out the discrete sensors so we can get a 3D measurement," explains Aiken.

You've Come a Long Way, Rip

For the measurement technology, everyone needed to be able to do a two-dimensional measurement of the wood at minimum, explains Aiken. "With a PLC, it was very expensive because you needed 32 high-speed counter channels," he says. "This measurement technique wasn't doable on a PLC frame because the cost of those high-speed counter cards was obscene. With the high-speed I/O, we were able to do the high-speed counter

features without the high-speed counter cards. We'd been in the high-speed scanning business for years with optical scanners. We were trying to move that functionality down to a lower price point."

The Brains Behind the Teeth

Control Logic selected the Beckhoff CX1020 Embedded PC with a 1 GHz Intel Celeron M paired with TwinCat NC PTP for complete automation, axis positioning and controls device management. The CX1020 is connected to a Beckhoff control panel with DVI/USB interface as the HMI hardware. For the amplifier, the ValuRip Plus features a digital servo drive with EtherCat interface. "The CX1020 brought Control Logic software efficiency, scalability and fewer required communication layers," says Aiken. "In addition, it features a direct backplane connection to EtherCat I/O terminals. With a single hardware device and TwinCat software, we can now combine the advantages of the PLC's hard real-time and the flexibility to choose programming languages, such as structured text, ladder and function block diagram."

In addition to the obvious controller efficiencies with regard to size and cost, the biggest functional improvement in the new control system was the I/O update rates, says Aiken. "This was very important to us because we wanted to create a very low-cost 2D shape scanner," he says. This requires a photoelectric array over which the lumber is transported with a high-precision surface. To perform the measurement, Control Logic had to sample the presence of the material at a very high rate—4 kHz—in coordination with encoder sources. "In the past, we couldn't poll the inputs with a PLC at this rate and were forced to perform the task using a PC I/O card and a custom device driver which we developed and maintained," explains Aiken. "So, the great improvement for us is that we are able to accomplish the scanning task without custom I/O frameworks or delicate in-house software. Even at the 4 KHz update rates, we only see about a 9–15% CPU load."

The Wave of the Future: TGW-Ermanco's Turbo Sorter

About three years ago, the engineering staff at TGW-Ermanco wanted to design a cost-effective, pop-up wheel conveyor for distribution centers. "Traditional pop-up wheel conveyor systems can move about 100 cases/min (cpm)," says Del Deur, director—product development, TGW-Ermanco in Spring Lake, Mich. "We wanted to design our new Turbo sortation system to move up to 200 cpm. In the distribution business, sortation rates can go up to 300/min. That's about the upper limit of a sliding-shoe sorter, the next step up from this system."

The Turbo sorter requires less space between cartons, resulting in higher throughput than a traditional pop-up wheel sorter. A series of narrow belts about 2 in. wide stretch across the width of the conveyor (Figure 3). Between each belt, the TGW-Ermanco engineers placed six rows of wheels designed to pop up when a carton approaches, explains Deur.

The Turbo sorter solves this problem by implementing the patent-pending Wave technology, which raises and lowers each row of wheels individually. The row raises as the leading edge of a carton arrives at the divert point, and lowers as the trailing edge is conveyed over the divert wheel row. With just one row of wheels moving at any given time, the cartons can be spaced much closer.

In order to move each row of wheels as quickly as possible, TGW-Ermanco's engineers needed a local controller at each divert point. "We found that even a PLC with a 10 msec scan time wasn't fast enough," says Deur. "In order to move the wheels and boxes as fast as our customers demanded, we needed a product that would complete program scans in the 1-to-2-msec range."

TGW-ERMANCO

WAVE OF THE FUTURE

Figure 3: Six rows of wheels pop up to create a "wave" at the divert point when the sorter is told a box is coming.

Let's Get It Started

"The first sensor on the conveyor itself is a bar-code scanner," explains Deur. "Then the package is tracked with software and an encoder that tracks the belt movement. The wheels are at the divert point. One row of wheels is raised up 3 in. before the box gets to the row. It's tracked physically with the programmable automation controller (PAC) used."

TGW-Ermanco looked at a few alternatives. "We did look at whether it's possible to take one overall system controller and get

enough speed for this local control, but we were pushing conveyor speeds of 425 ft/min," says Deur. "With the resolution we wanted, we didn't see any controller that would work at that speed. For resolution, you're trying to convert down to an inch or half-inch. Pulses coming in at that resolution get down to the millisecond range. We need a minimum of 6 in. That's enough time to get the wheels up with the pneumatics. But we don't want to add more time for the logic to react."

To help meet the program scan time requirement, the ArmorBlock MaXum I/O module with DeviceLogix technology was used for each divert point. DeviceLogix technology, which is embedded in the ArmorBlock module's internal miniprocessor, provides the programmable logic without having to loop back through the central PAC, says Deur. DeviceLogix embedded firmware is an extension of basic component functionality that controls outputs and manages status information. As part of the I/O block, it combines inputs and outputs and programmable local logic to determine behavior.

"The central controller does the tracking," explains Deur. "Once a product is scanned and introduced to the sorter, the PAC takes over. When the carton gets close to a diverter, it informs the diverter control over DeviceNet. That's when the carton is within a few inches of a sensor that's prior to the divert wheels. The sensor is plugged into the ArmorBlock I/O module. That's the trigger. You block that sensor at the same timing window that the main controller says, 'Here's a carton.' Then the diverter takes over. There's a retro-reflective presence sensor just looking for the leading edge of the carton."

Different Way to Communicate

TGW-Ermanco typically does its remote I/O through Ethernet, but this specific application called for DeviceNet, says Deur. "We don't use much DeviceNet, but this just happened to come in a DeviceNet format," he says. "If this were in Ethernet, we'd use it as Ethernet. The advantage is we use the flat ribbon cable which allows us to get power out to these devices. There are six solenoids per divert location, so we do need to get power out to them, and this is done without conduit. A giant distribution center might have 50 divert points. We tend to work with smaller customers, where you probably have 16-24 divert points."

By carrying out logic control at the divert point rather than at the centralized master PAC, the time for an input to be sensed and an output to be actuated decreases significantly (Figure 4). TGW-Ermanco engineers were able to complete the necessary program scans in fewer than 2 msec.

Proof Is in the Sorting

J.J. Phelan, PE, chief operating officer at TriFactor (www.trifactor.com), a material-handling system integrator in Lakeland, Fla., installed a Turbo sorter at a distribution center for a leather goods retailer. "It's a 579-ft ship-

TGW-ERMANCO

LOCAL TRAFFIC

Figure 4: Logic in the I/O module allows control at the divert point, rather than looping back through the centralized controller.

ping sorter located on a mezzanine above the shipping dock doors," he explains. "Cartons in average length of 22 in. at a rate of 60 cartons/min are inducted into the sorter. Prior to induction, cartons are merged with the recirculation line with a two-to-one combiner. There are 18 existing or active divert lanes and two future divert lanes on which the sorter tracks all cartons and diverts to the right side appropriately. Once diverted, a confirmation signal is returned to ensure tracking accuracy. Also, each shipping line has a full-lane photo eye that tells the sorter to skip diverting to that lane and recirculate product until the full-lane photo eye is cleared."

The throughput rate of the Turbo sorter fits between those of the more-expensive shoe sorter and the lower-speed pivot wheel, pop-up wheel or urethane belt transfer, explains Phelan. "Before the Turbo sorter, customers had to make a sacrifice, either spend more money for a high-speed sorter in preparation for future growth, even though current demands don't require the rates, or spend less money but limit the growth potential and future throughput requirements. The Turbo sorter allows a customer to spend the proper amount of money on a sorter that can accommodate current and foreseeable future needs."

The Turbo sorter also was implemented in late 2008 in Petco's distribution center in Braselton, Ga. "It was an application we were looking for," says Mike Fernstrom, director of distribution operations at Petco (www.petco.com). "A sliding-shoe sorter could have done the job, but the cost would have been higher, and in my other experiences with shoe sorters, there have been issues with missed diverts. We're considering the Turbo sorter for other Petco facilities now. We've got one merge operator at the facility, but the sorter runs itself. It was installed and ready to go in less than 45 days." CD

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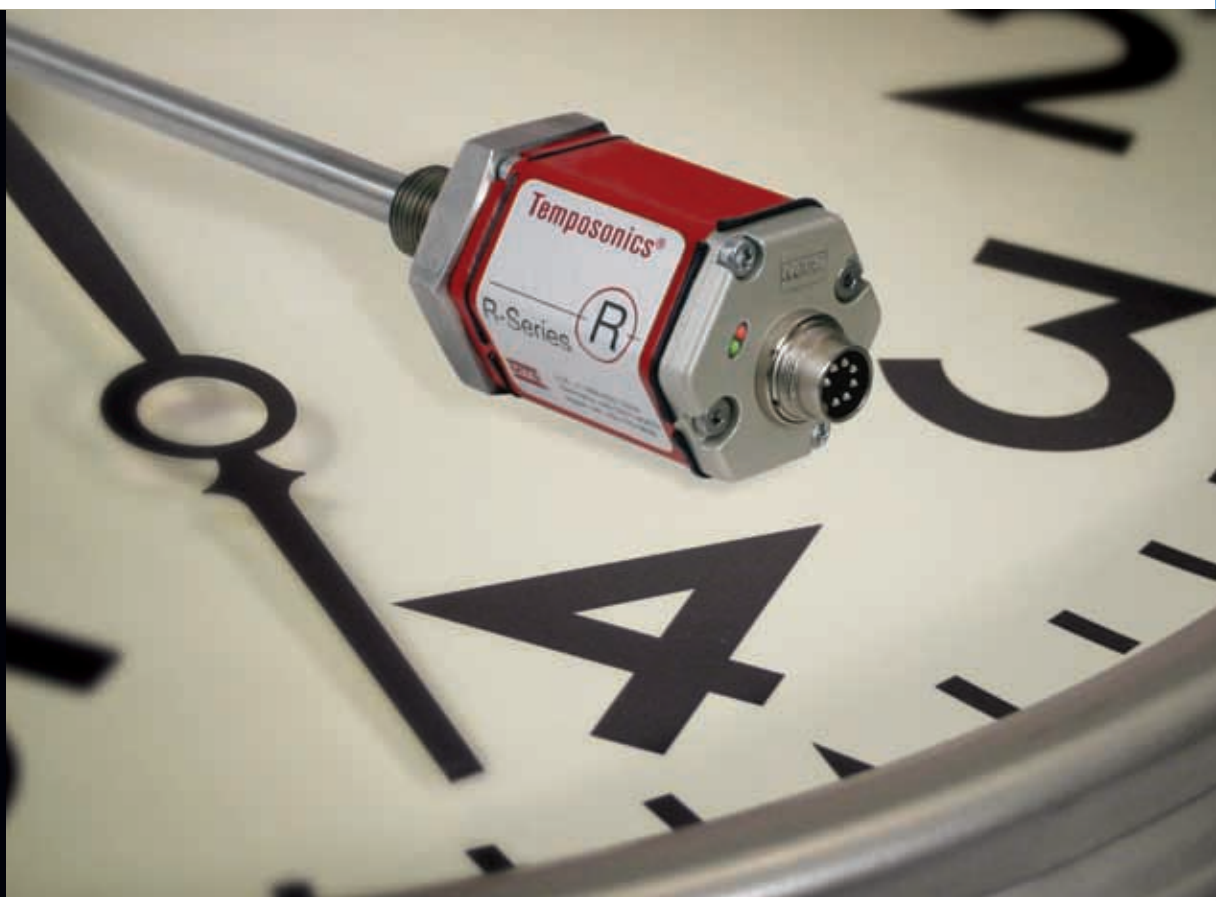

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Measurement Options With Lasers

Laser-Based Sensing Provides a Unique Set of Capabilities That Are Well-Suited for Difficult Measurement Tasks

by Phil Burgert

SENSING AND MEASURING based on laser technology that offers tightly focused measuring-spot ranges and flexible mounting-distance options are finding their places in a wide range of applications that need very accurate alternatives to 3D vision.

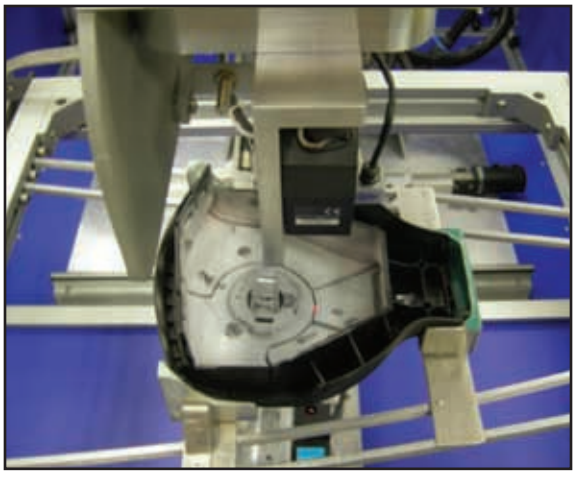
Very-high-speed measurements with high resolution and repeatability are possible with lasers sensors. Other advantages include an ability to "reach" into difficult-to-access locations to provide precise metrology.

On the Spot

"A small spot size is really the only practical way to measure certain components or to measure an inside dimension, because lasers are used mainly for dimensional measurement; camera sensors, on the other hand, are used to determine the presence or absence of a part," says David Lacey, president of system integrator Oryx Systems (www.oryxsystems.com), Indian Trail, N.C. "When you get to actual metrology, that's when the lasers really show off their strength." Oryx builds custom and special-purpose measurement machines.

Lacey says, compared with proximity sensors, a key advantage of laser sensors is their stand-off distance. "They don't have to be very close to the thing being measured," he says. "They also have a good measurement range. Unlike cameras, of course, laser sensors don't need special lighting. They can work in dark and shadows."

Lacey notes that lasers sensors come in a variety of configurations. "Almost as many types as proximity switches," he says. "They rival proximity because of the non-contact nature and the stand-off distance. But their greatest advantage is in doing high-accuracy, high-resolution measurements in non-contact mode looking for dimensions."



ORYX SYSTEMS

IN THE GROOVE

Figure 1: Laser inspection is used in this application to check tear seam grooves molded into automotive air-bag covers.

Topography is an area where lasers excel, says Lacey. "Vision systems can sense height but not as accurately as lasers can." The non-contact nature of laser sensors is also an advantage for measuring parts that could easily be damaged, he notes. "To measure soft parts, for example, solder paste or metals such as lithium, you can't touch the stuff with anything," says Lacey. "The only way to do dimensional measurement is with a non-contact gauge and in most cases the lasers are more suitable than other types."

Lasers also allow for measurement in limited access areas, he says, noting some custom-manufactured parts in automobile, aircraft, batteries and medical as examples, since they often are in unreachable locations (Figure 1). "They are very, very small. You're looking down a hole and trying to measure the wall thickness at the bottom of the hole or measure the

LASER TAG

Laser sensors provide advantages over presence sensors, such as access to difficult-to-reach locations and dimensional measurement, but these upsides translate into a more expensive component. Tell us what you're using laser sensors for at www.ControlDesign.com/laser.

height of a feature down a hole," he says. "There are many applications where a laser can excel at that."

Mind the Details

Lasers can be difficult to use on a highly polished surface. In those cases a capacitive sensor that is less dependent on surface textures is a better solution, says Lacey. "But the capacitive sensor will measure even the smallest oil spot as well, whereas the laser doesn't. There's always a compromise."

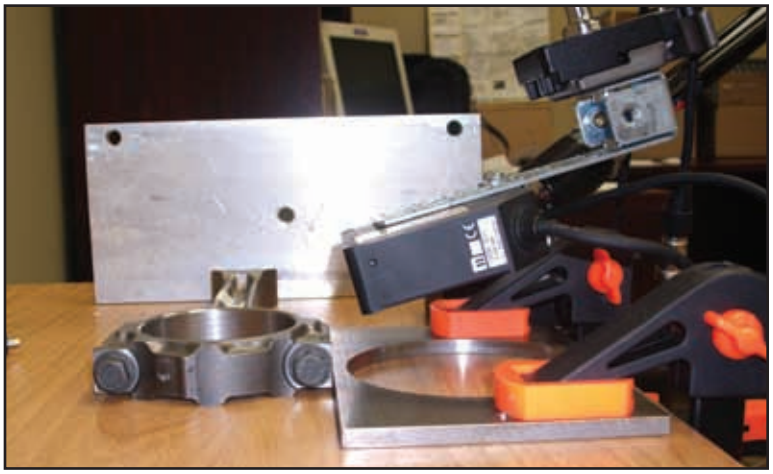
The spot size of the laser also sometimes works against it. With a really tiny spot size in the one-half micron range, it can pick up small, inconsequential deviations in the surface, which create problems. A larger area sensor tends to average and provide a smoother signal, says Lacey.

"With the correct application, the laser sensor can outperform these other devices for accuracy, repeatability and access to a small area," he says. "But you still have to do the right signal processing and averaging to get data from the signals to process it properly. You simply can't aim the laser and get a reading."

Of the many laser-based applications that system integrator Vista Solutions (www.vistasolutions.ca), Windsor, Ontario, has developed, about 90% use laser sensors such as a displacement sensor for precise and accurate sensing results, says Aaron Bouchard, vision specialist. "We tend to always use the smallest laser point that you can get," he says. "That would be the main advantage."

> "Unlike cameras, of course, laser sensors don't need special lighting. They can work in dark and shadows."

The accuracy of lasers is an important advantage, says Bouchard, who notes one application Vista Solutions developed involves measuring the inside of a forged housing by spinning a displacement sensor with a servo motor inside the forging and capturing analog values of the points in space (Figure 2). "It's providing the distance from the sensor and we know where it is when we spin it," Bouchard says. "We're plotting those



VISTA SOLUTIONS

ACCURATE AT AN ANGLE

Figure 2: This lab evaluation shows a laser sensor checking the depth of a machined notch on a forging. The unique setup involves a 30° reflective angle because a parallel configuration could not be used.

points to determine whether or not the shape of this forging is correct."

Along with other machine-vision systems, Vista Solutions uses displacement laser sensors in determining the 3D position of objects in manufacturing systems. "We do a lot of 2D robot guidance and we'll sometimes need a third dimension," says Bouchard. "Rather than use a full-blown 3D pickup system with a lot of development costs, for the right application you can use a 2D camera and two or three displacement sensors to get the plane of the part so you'll know where it is in space and you can adjust your robot to pick it up. It's really a complementary technology that can be much less expensive."

Vista Solutions also uses laser presence sensors for critical timing in applications that look for a part moving on a manufacturing line. The laser sensor provides much greater accuracy because, as the part passes, it only has to break the small laser dot rather than a larger photo-eye surface, says Bouchard. He notes that the cost of laser sensing might be a little higher than some other solutions, so depending on the applications an inductive sensor or photo-eye might be a preferable way to achieve presence detection or other results.

Lasers also can be best to detect, for example, the presence of a rubber seal on a black part when there's poor contrast between the two pieces, says Bouchard. "You throw a laser line across it and you actually can see it with just a standard 2D camera," he says. "You're not doing any measurement calculations based on an algorithm. You're just checking to make sure it is present based on a laser line skipping up rather than running straight across."

Rick Bondy, product manager for Sick (www.sickusa.com), says that in the past most photoelectric sensors used infrared light sources and the wavelength was not visible to the human eye. "It made alignment very difficult and trial

by error in most applications," he says. "With visible-red-light-emitting-diode sources, installation and setup improved significantly, since the installer could see the light hitting the target."

The problem with both of these light sources was the control over the physical size of the light spot at varying distances, he adds. Similar to the light from a flashlight tending to flare out as it exits the housing of the flashlight, the optical-light-beam diameter of a photoelectric sensor also gets larger further from the lens.

Controlling the size of the light spot size is especially critical in manufacturing applications that call for smaller machine footprints on the factory floor, in which targets are getting smaller, says Bondy.

Laser Specs

Laser light sources enable factory automation applications that require precise, pin-point light-spot sizes to be developed reliably and at competitive cost, states Bondy. "Most lasers used today in factory automation are Class I or Class II lasers, as regulated by government agencies, and are considered safe due to their extremely low average power output," he says.

Typical applications include product height/width, diameter, thickness, roundness, eccentricity, and profiling, notes Bob Hosler, regional product sales director for Keyence of America (www.keyence.com), adding that the laser technology that has become very popular recently is two-dimensional, laser-displacement sensing. This technology essentially combines laser distance measurement (triangulation) with vision technology involving either two-dimensional charge-coupled device (CCD) or complementary metal–oxide semiconductor (CMOS) receiving elements to create a displacement profile of the target and enabling stable defect inspection or gauging without problems frequently associated with machine vision, such as inconsistent lighting and part variation, explains Hosler.

> "With visible-red-light-emitting-diode sources, installation and setup improved significantly, since the installer could see the light hitting the target."

In packaging applications, lasers can be used to count a magazine of unfolded corrugated cardboard cases or cartons or to verify if minor and major flaps are fully inserted, says Jeff Allison, product manager for Pepperl+Fuchs (www.pepperl-fuchs.com). He notes that material-handling applications often employ laser displacement sensing for absolute positioning of automated storage and retrieval or printing applications can use laser sensors to count individual sheets of paper in a sheet-fed press. CD

PHILIP BURGERT is a freelance writer, specializing in technical trade media.

Nothing Like Good Connections

A VARIETY OF factors come into play when choosing between different types of terminal-block connectors such as standard screw clamps, spring clamps and euro connectors that are used for wire and cable connections in machine control systems.

Tracy Lenz, senior product support engineer for Wago (www.wago.us), says the differences between termination methods boil down to install techniques, long-term connection integrity and maintenance. Screw clamps rely on an installer applying proper torque for termination, but normal operational vibrations and temperature cycling that occur even during machine transport from factory to customer site can loosen screws, notes Lenz. Loose connections eventually will fail if not re-tightened to the appropriate torque spec prior to the component being initially installed, and later during maintenance. "A 20-cent connection can lead to a day's worth of downtime devoted to troubleshooting," says Lenz. "Screw clamps typically rely on specialty tools such as torque wrenches or crimpling lugs and installer training to meet appropriate torque specs. Over-torquing essentially crushes the conductor, causing failure."

But Alan Sappe, product marketing lead specialist for Clipline industrial connection technology at Phoenix Contact (www.phoenixcon.com), says DIN-rail-mounted screw-type terminal blocks are still prevalent in control cabinets, switchgear and specialized signal connections. "Time-proven screw terminations deliver a secure connection with the highest clamping force, and include mechanisms to help prevent screw backout," says Sappe. "Another key advantage with screw connection is the ability to land multiple wires to a single terminal, saving panel space."

To protect against corrosion, some companies, including Phoenix Contact, ensure that the clamping bodies in screw connection terminal blocks are protected by a high-grade, corrosion-resistant galvanic nickel- or tin-plated copper alloy.

As an alternative, says Lenz, spring connections essentially enclose a conductor on all four sides for retention and connection integrity while using proportional clamping forces to ensure a conductor receives clamping forces appropriate to its size. "This eliminates special install tools or special training to ensure screws are tightened to proper torque specs," says Lenz. "It also prevents damage caused by over-torquing." Spring clamps also are well-suited to high-vibration applications, since they resist vibration and temperature cycling, while screw connections expand and contract with operating temperature changes, says Lenz.

Compared to screw-type terminations, spring-cage terminal blocks can be a faster method of connection, and can reduce wire termination time by as much as 25% or more, says Sappe.

Alan Stewart, technical and application engineering manager for Weidmüller (www.weidmuller.com), says M12 euro connectors in an IP65/67 housing are usable in harsh environments, where connections must withstand exposure to solvent and chemicals and have the ability to protect from mild impacts.

But, he notes the disadvantages of using M12 euro connectors include a limited number of connections per connector and generally higher prices, although when the price of protecting IP20 connections is considered, the cost of using the M12 connection types is not significantly more.

> **DIN-rail-mounted screw-type terminal blocks are still prevalent in control cabinets, switchgear and specialized signal connections.**

"Often standard connections provide many more ways to make the electrical connections," says Stewart. "The major differentiator is the environment where the connection is made. Standard connectors generally won't provide safe and secure connections in harsh environments without some type of protection."

Jeff Schoenberg, product manager with Turck's connectivity division (www.turck.com), suggests that lower overall cost and a reduced chance for wiring errors can be an advantage for euro connectors since most terminal-block wiring is done in the field, making it more expensive. Changeover flexibility because of the plug-and-play nature of euro connections is also an advantage when maintenance, repair and operational changes need to be made, since this limits repair costs and downtime of a machine, he says. CD

Philip Burgert is a freelance writer specializing in the technical trade media.

Phil Burgert · philip.burgert@pipeline.com

Safety: Part of Machine Design

International Standards Create More Need to Include Safety Earlier

FOR MACHINE BUILDERS, compliance with U.S., EN and IEC safety standards is becoming the de facto requirement for doing business, and safety now is designed in at the early stages, says Dave Collins, manager, machine safety products, at Schneider Electric (www.us.schneider-electric.com). "That offers less potential for untrained operators to tamper with the safety equipment," he thinks.

International standards organizations are cooperating more to develop consistent global guidelines for safeguarding machines. "Within European law, the supplier/machine builder has the responsibility to deliver new machines that are 'safety-inclusive,'" explains Juergen Bukowski, safety program manager, Sick (www.sick.com). "U.S. law requires employers/users to take their new or already-operated equipment and provide a hazard-free environment, which often means users have to design safety around it."

From a design standpoint, safety standards serve as an important guideline, explains Doug Meyer, solutions marketing manager, Yaskawa Electric America (www.yaskawa.com). "The standards replace much of the subjective interpretation about what is safe with objective criteria," he says.

Safety standards provide criteria for selecting the appropriate approved or certified components, agrees Eric Hollister, product sales engineer, Pilz (www.pilzusa.com). "They offer advice for the entire safety design process, from evaluating the overall risk of a machine or process through design, and all the way to implementation and validation," he says.

"Modern network safety technology makes it possible to instantly safety-stop a machine, easily segment an application into safety zones or quickly diagnose a safety device," explains Tracy Lenz, senior product support engineer, for Wago (www.wago.us).

LOW-COST CONTROLLER

The SafetyOne FS1A safety controller can replace six safety relay modules. It can be configured simply by turning on a

logic switch. One module can connect with emergency-stop switches, pilot lights, sensors and light curtains. The FS1A is UL-listed, TÜV-rated and CE-marked. It also meets IEC 61508 integrity level 3, ISO 13849-1 performance level e and EN954-1 safety category 4.
IDEC; 800/262-4332; www.idec.com/usa

SAFETY STARTER

The Contactron "4 in 1" motor starter is rated for safety category 3, SIL 3 and ATEX Zone

2. The motor starter can be installed in industrial machine safety applications of up to safety category 3 per EN951-1. Applications include emergency stop, safety door and light curtains. This product is commonly used in combination with a safety relay to control motors, valves, fans, pumps, actuators and VFDs.
Phoenix Contact; 800/322-3225; www.phoenixcon.com

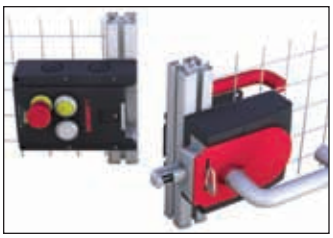
COMMUNICATING CONTROLLER

The XPSMC safety controller provides the same functionality as multiple safety relays and is an alternative to safety relays and safety PLCs. It reduces panel space and simplifies wiring and is available with either 16 or 32 inputs, and with eight safety outputs. All outputs can be converted into timed outputs. External communication is available via Modbus,

CANopen or Profibus.
Schneider Electric; 888/778-2733; www.us.schneider-electric.com

MAKE DOORS SAFE

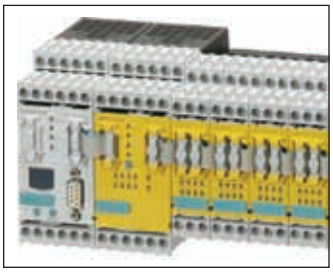
The Multifunctional MGB gate box is a safety switch, bolt and door-locking mechanism in one system and combines all necessary requirements



to protect a safety door in accordance with EN ISO 13849 and EN 1088. The core of the modular system is the evaluation module, which is available with and without guard locking. In combination with a handle module and an optional escape release, the MGB protects almost every safety door.
Euchner; 866/547-7206; www.euchner.com

MODULAR SAFETY CONTROLLER

The Sirius 3RK3 modular safety system combines the simplicity of a safety relay with the sophistication of a fail-safe programmable logic controller. The system's central unit is designed with eight safety-related inputs, one safety-related relay



output and one safety-related solid-state output. Users can connect up to seven expansion modules to the central unit for specific application requirements. A non-safety-related DP interface module is available for communication with higher-level controllers via Profibus.
Siemens Energy & Automation; 800/964-4114; www.sea.siemens.com

ON GUARD FOR SAFETY

The G9SX-GS safety guard switching unit has external outputs to enable status indication of two safety input devices. Auxiliary outputs enable monitoring of safety inputs, safety

outputs and errors. Detailed LED status indicators provide quick system diagnostics. Logical AND connections help facilitate complicated applications in combination with other G9SX series units. The unit also supports unique auto switching and manual switching functions. Auto switching ensures safety and productivity in applications with coordinated operations.
Omron Scientific Technologies; 800/479-3658; www.sti.com

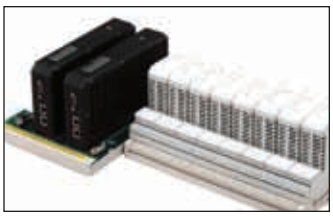
SLIM LIGHT CURTAINS

The SLCS and SLCT series safety light curtains are available in IEC 61496-compliant Type 4 or Type 2 versions. These high

resolution and ultra-slim safety light curtains reduce the safe mounting distance with respect to the point-of-operation hazard, enabling them to be installed in space restrictive applications. The small footprint, just 20 mm wide x 30 mm deep, and optional quick-release mounting bracket facilitates fast, flexible mounting.
Pepperl+Fuchs; 330/486-0001; www.pepperl-fuchs.com

DUAL-PURPOSE CONTROLLER

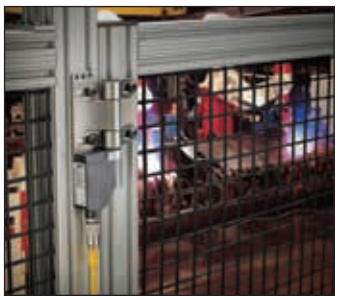
The PAC8000 SafetyNet has been approved by TÜV for applications requiring the handling of safety and process control data in the same controller. A 24 Vdc power supply extends the locations where SafetyNet systems can be implemented.



The PAC8000 SafetyNet can handle safety and process control data in a single controller for SIL2 applications. PAC8000 SafetyNet offers static analyzer tools to identify all instances of the use of non-safety data in the safety controller.
GE Fanuc Intelligent Platforms; 800/433-2682; www.gefanuc.com/process

SWINGING DOOR SAFETY

SI-HG63 series hinge safety interlock switches offer NC safety contacts. When the

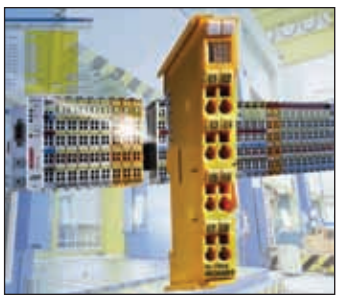


hinge switch is activated, these NC safety contacts are forced open by a non-resilient, mechanical means, interrupting the electrical circuit and sending a stop signal to the machine control.

Banner Engineering; 888/373-6767; www.bannerengineering.com

THREE-WAY SAFETY

KL6904 TwinSafe bus terminal has a safety-rated controller, four safety-rated outputs and



interfaces for Profibus and EtherCat. KL1904 has four digital inputs with potential-free contacts rated 24 Vdc. KL2904 has four 24 Vdc digital outputs rated at 0.5 A. If more safety I/O points need to be controlled, multiple KL1904s can be used to handle up to 4,000 I/O points.

Beckhoff Automation; 952/890-0000; www.beckhoffautomation.com/twinsafe

WARNING LIGHTS

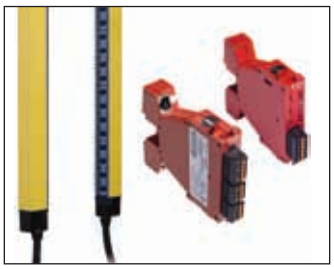
Signal50 50-mm, CE-compliant warning tower lights indicate when a particular defined action should be initiated. Choose from 100 combinations of lenses,

voltages and illumination types including incandescent, LED, strobe, flashing and more.

Omega Engineering; 203/359-1660; www.omega.com

SHIELD ADDS OPTIONS

The Allen-Bradley Guardmaster GuardShield safety light curtain line now has three cost-effective options: the GuardShield Safe 4 with an integrated laser align-



ment system, the GuardShield Cascadeable Micro 400 and the GuardShield Safe 4 PAC. Integrated laser alignment simplifies setup and installation. The GuardShield Cascadeable Micro 400 safety light curtain is designed for small assembly machines where mounting space is limited. The GuardShield Safe 4 PAC light curtain offers an expanded operating range.

Rockwell Automation; 414/328-2000; www.rockwellautomation.com/go/pr-lightcurtain/

SAFETY MADE EASY

SafeDesigner development and configuration tool provides integrated safety for programming safety-related functions in the Automation Studio development environment. Programming the safety application is reduced to virtual wiring of logical function blocks. The safety application

created in SafeDesigner is processed in a safe controller—the SafeLogic —that supports cycle times starting at 1 msec and connection of up to 100 peripheral devices.

B&R Industrial Automation; 770/772-0400; www.br-automation.com

LINK SAFETY SYSTEMS

The Smart Safety Net links safety systems and safety relays in an easy and safe manner. By the use of the data bus technology, the time and effort for wiring is reduced considerably. It also makes it possible to build safety groups, so it is possible to turn off only one part of a facility to carry out maintenance. No IP address, special knowledge,

special cable, special tools or IT expertise is required.
EMS Controls; 941/637-9669; www.switchingdevices.com

FAILSAFE ALARM MODULE

The STA safety trip alarm accepts a signal input from transmitters, temperature sensors, resistance and potentiometer

devices, and a wide range of other monitoring and control equipment. It provides three failsafe alarm outputs and is certified to IEC 61508: Parts 1, 2 and 3 by TÜV Rheinland for single use in safety instrumented systems up to SIL 2.
Moore Industries-Int'l; 818/894-7111; www.miinet.com

FAST SWITCH

The One Series line of digital pressure and temperature switches were recently evaluated by Exida Consulting for

FMEDA and SIL Verification for plant safety applications needing faster response to initiate immediate and critical safety shutdowns. The switches never need calibration, have programmable adjustability and 0.1% repeatability.
United Electric Controls; 617/926-1000; www.ueonline.com

REDUCE ARC-FLASH HAZARDS

Quik-Spec safety switch uses IP-20 finger-safe CubeFuse integration which has current-limiting Class J performance to reduce dangerous arc-flash hazards, both in energy and incident levels. The flange-operated handle is easy to operate with electrical gloves and is lockable with up to three padlocks to protect maintenance workers.
Cooper Bussmann; 636/527-1449; www.cooperbussmann.com

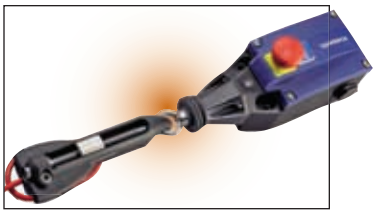
SAFE BRAKING

LazerSafe LZS-003-HS safeguarding system developed

for hydraulic press brakes makes complex bends with a minimum of settings while maintaining press speeds. Two flat bands of 40-mm-wide laser light continuously monitor the zone below the punch. It can detect obstructions to 4 mm, while remaining tolerant to inherent vibration.
Honeywell Wintriss Controls; 800/586-8324; www.wintriss.com

TENSIONING DEVICE

Series S900 tensioning device works with the company's family of emergency cable-pull wire switch installation accessories. It is designed to speed the installation of emergency-pull switches by replacing the turnbuckle and most of the



wire clamps. The device has an onboard wire clamp and an anti-slip design to minimize the need for readjustments.
Schmersal; 914/347-4775; www.schmersalusa.com

BEAM SENSOR

The ST4 series compact type 4 safety beam sensor offers a solution for machine guarding applications in which the installation of safety light curtains is cost-prohibitive or impos-

sible due to space constraints. The sensors provide 0.1–15 m sensing range to cover narrow spaces to wide areas where light curtains are hard to install. The sensor head measures 14 mm x 31 mm x 28 mm.
Panasonic Electric Works of America; 877/624-7872; www.panasonic.com CD

MORE, MORE, MORE

Find more information about safety components from companies including **Elobau**, **Pilz Automation Safety**, **Sick**, **Wago** and **Yaskawa** at www.ControlDesign.com/roundupsarchive.

Servos and Steppers Resume Rivalry

WE'VE USED SERVO motors for most of our axis-positioning requirements. We hear that some newer stepper motors now incorporate closed-loop position control that rivals servos, and still provide better torque. Any evidence out there about this?

—from May '09 CONTROL DESIGN

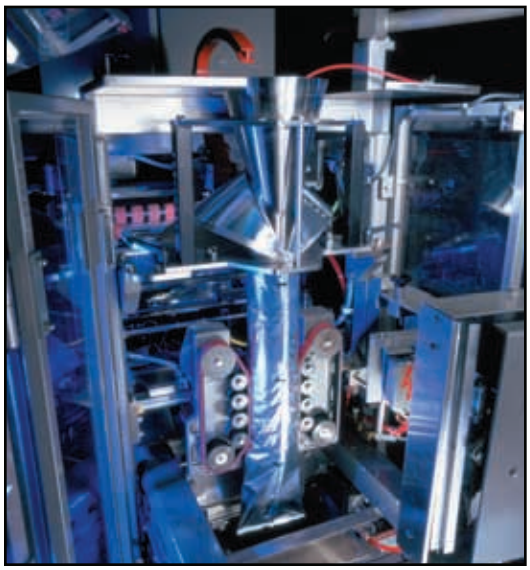
ANSWERS

Don't Exceed Expectations

Stepper systems are much less expensive than servo motor and amplifier systems. Some vendors have added functionality to their standard stepper amplifiers that allow for closed-loop operation. It's been my experience that this type of functionality adds significant cost and makes the stepper amplifiers approach the cost of a servo amplifier. I would say that the majority of stepper systems sold are your basic open-loop amplifier and motor without a feedback device.

What are you giving up for the discounted price of a stepper system? Mainly performance and stability. Because of the inherent design of a stepper system, high-speed operation is not really practical. At speeds above 500 rpm or so, the available torque drops to around 30-40% of stall-torque value. As you increase speed, the available torque drops to almost nothing. Stepper motors also stall—they become unsynchronized, losing torque and position—when the torque demand is greater than the available torque. This means you normally need to account for a significant safety factor when sizing a step motor. This also makes stepper systems not so ideal when the load changes or when the load is not consistent in the application. You have to size for the worst-case scenario. There is no intermittent peak torque level with a step motor.

Stepper systems also have unavoidable resonance points. These are specific operating frequencies where loss of torque could occur. There is a low-speed resonance point around 50 rpm and a mid-range resonance point around 500 rpm. Most stepper amplifiers these days take some measures to counteract these resonances, but normally the user will end up simply designing around these speed ranges. Stepper motors are ideal for low-speed applications in which the load is unchanging.



YASKAWA

STEP ON IT

Stepper motors are ideal for low-speed applications where the load and motion profile don't change.

Once you try to get more than that out of a stepper, you're in for some problems. As far as digital networks and integrated safety go, steppers are not that high up on the food chain. The standard for controlling stepper amplifiers is with a pulse and direction command, typically coming from a PLC or other simple pulse-generating device.

I am not aware of any stepper amps that have integrated safety.

Scott Carlberg, product marketing manager, Yaskawa Electric America, www.yaskawa.com

Two Steps Forward

Stepper motors are synchronous motors with a high number of poles, which can be regarded as direct drives. The advantages of stepper motors include high holding torque and very-good positioning capability. Individual steps or partial steps can be approached directly (i.e., without return system) through intelligent control of the stator windings in full-step or micro-stepping mode. This distinguishes stepper motors from servo motors and makes them a cost-effective alternative.

Excessive acceleration and fast load cycles can cause the stepper motors to become unable to fol-

low the rotary field and "lose" steps. An encoder can help avoid problems in this situation. Stepper motors have their maximum torque in the lower speed range and an overriding holding torque at standstill. In many applications this makes a holding brake unnecessary.

Our I/O system features stepper motor terminals that can store suitable current curves for any speed or load profile, permitting optimum adjustment of the thermal motor load.

Bob Swalley, applications/support engineer,
Beckhoff Automation, www.beckhoff.com

Unnecessary Feedback

Generally, servo motors are available in a much wider power range than stepper motors. We offer servo motors from 0.1 to 160 hp and stepper motors from 0.1 to 1.8 hp. As a result, servo motors offer more choices for a wide power range of applications.

A fairly new development in stepper control is to incorporate a rotor-position feedback—encoder or resolver—to optimize torque generation according to actual rotor position. This turns the stepper motor into a high-pole-count, brushless servo motor. An advantage of this technique is to normally run the motor in open-loop mode and only enter closed-loop mode if the rotor position error becomes too large.

The added encoder system feeds back the actual position to the drive to correct the number of steps performed if the motor loses some steps due to high load inertia and fast acceleration. However, it still does not position the motor between two steps. Hence, the added feedback does not improve the resolution and positioning accuracy of stepper motors. This typically is between 500 and 50,000 steps per revolution, while a servo motor with a sin/cos encoder offers a resolution of $> 4 \times 10^6$ counts per revolution.

Ralph Baran, product manager,
Siemens Energy & Automation, www.sea.siemens.com

Servo Stepper Controller

Stepper motors and associated components have evolved, taking on new functionalities. An example would be our servo stepper controller that is equipped with encoder feedback capabilities to function as a closed-loop controller.

The torque is there with these servo stepper controllers; however, it's also important to consider how well the component actually transmits that torque to your application. Select servo stepper controllers operate on a resolution of 64 microsteps, preventing step losses caused by acceleration and a finer step position. High resolutions prevent excessive wear on mechanical components. Furthermore, these servo steppers have current control, minimizing any power dissipation while increasing torque efficiency. Also consider vector control. When paired with the incremental encoder, vector control creates highly efficient rotational speeds.

Servo stepper controllers also offer six configurable inputs for start/stop, end-stop, reference, jog/tip, and can be processed directly via internal software. Two outputs can be linked with internal functions or used freely. This ensures servo stepper controllers can adapt easily to meet application needs via various acceleration ramps, command tables, auto reference and other event-driven characteristics while ensuring no position loss.

Mark DeCramer, product manager,
Wago, www.wago.us

SEPTEMBER'S PROBLEM

OUR PRINTING MACHINES consist primarily of discrete I/O with a small quantity of analog I/O. We ship these machines worldwide, and to reduce startup time and travel we plan to start doing more extensive shop testing. Right now, we test on-machine I/O to some extent. But some I/O cannot be tested easily as it's either field-installed or requires actual production for responses to make sense. For those I/O points, is software simulation the answer? Or should we go with hardware simulation by wiring at least some outputs to devices and reading responses at the inputs?

SEND US YOUR COMMENTS, SUGGESTIONS OR SOLUTIONS FOR THIS PROBLEM. We'll include it in the September '09 issue and post it on ControlDesign.com. Send visuals if you'd like—a sketch is fine. Email us at RealAnswers@putman.net. Please include your company, location and title in the response.

HAVE A PROBLEM YOU'D LIKE TO POSE to the readers? Send it along, too.

PRODUCTS

PROPORTIONAL CONTROLLER

C2 Proportional System Controller for proportional pneumatic valves can be used to

control non-pneumatic devices or as a stand-alone advanced PID controller. It has a backlit graphic LCD and membrane keypad to access intuitive configuration and tuning menus, including independent scaling of command and feedback signals, command ramp rates and electronic valve offset and can save and recall up to 10 user configurations.

Enfield Technologies; 800/504-3334; www.enfieldtech.com

THIN-CLIENT COMPUTERS

MEPC-series miniature computers fit on the palm of your hand for thin-client applications

where space is at a premium. Aluminum cases provide industrial-grade toughness and cooling without noisy fans. A 1.2 GHz VIA Esther CPU is standard; optional LAN is available.

CyberResearch; 800/341-2525; www.cyberresearch.com

MINI LEAD SCREWS

Mini Series lead screw assemblies, for miniature motion control applications, such

as dispensing systems and micro-actuators, are offered in anti-backlash and general-purpose lead screw assemblies, using Kerk NTB, NTG and BFW nut designs. Made of 303 stainless steel, the assemblies are available as small as 0.125 in. and come with self-lubricating polymers.

HaydonKerk Motion Solutions; 800/243-2715; www.haydonkerk.com

MANY COLORS

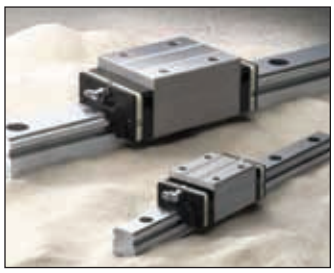
Entry-level In-Sight Micro 1100C provides standard (640x480) resolution; high-performance 1400C doubles processor perfor-

mance; In-Sight 1403C is a two megapixel (1600x1200 resolution) system for high-resolution inspection in color applications. In-Sight Explorer v. 4.3 software has a Color Match high-speed color sortation tool for 24-bit color resolution.

Cognex; 508/650-3000; www.cognex.com

DUST-PROTECTED GUIDES

The V1 series of linear guides for applications with heavy exposure to particles like graphite powder and sawdust use high-performance seals with a multi-lip structure as



well as caps for rail mounting holes to reduce the entry of fine contaminants. The V1 series is available with low-temperature chrome or fluorinated chrome plating surface treatments.

NSK Precision America; 317/738-5000; www.nskprecision.com

RUGGED MONITOR

Model TT-840 environmentally sealed LCD monitor has an 8.4-in. sunlight-readable display encapsulated in a rugged aluminum enclosure sealed to IP68/NEMA 6P specifications. It is watertight to resist liquid, dust and dirt intrusion, will op-

erate in extreme temperatures, -20 to 60 °C, and has up to 1,000 nits of brightness and a 600:1 contrast ratio.

Stealth.com; 888/783-2584; www.stealth.com

SOFTWARE

ONLINE ANALYSIS

Global Performance Advisor extends online machinery monitoring to predict performance of assets by identifying deterioration of critical machinery in real time and combines protection, prediction and

performance monitoring with process control. It complements AMS Suite: Equipment Performance Monitor application that provides analysis of equipment performance.
Emerson Process Management; 314/553-1900; www.emersonprocess.com

COMPLIANT ENVIRONMENT

IsaGraf's IEC 61131-3/IEC 61499-compliant control software environment lets users create local or distributed control systems with PACs, PLCs, DCSs, RTUs, CNCs, embedded microcontrollers or motion controllers.

It offers the portable Virtual Machine control engine and the Workbench application-development environment. Toolkits are designed for full customization and access to portable source code for implementation on any OS and hardware platform.
IsaGraf; 877/868-4746; www.isagraf.com

RESOURCES

ONLINE DESIGN DATA

Data Portal is a Web-based portal designed to streamline integration of device data into the design process. The portal includes macros of components and subcircuits, assembly drawings, function templates for intelligent device selection, international designations, preview images and manuals. The portal allows the users to select components directly from the server with the functions of a Web application and then insert them into the design environment via drag-and-drop.
Eplan Software & Services; 248/945-9204, x104; www.eplan.us

LEAN & GREEN

Developed with lean expert Jamie Flinchbaugh, "Lean and Sustainability" discusses lean and sustainable manufacturing. The challenge is how to effectively use lean as a tool to drive sustainability in manufacturing operations. The guide shows how waste reduction lies at the heart of both lean and environmental improvements.
Bosch Rexroth; 800/739-7684; www.boschrexroth-us.com/lean CD

AD INDEX

control design
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is the only magazine exclusively dedicated to the original equipment manufacturing (OEM) market for instrumentation and controls—the largest market for industrial controls.

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Let's Interface About Interfaces

AS I WALKED through a trade show recently, I paid special attention to the screen designs of the operator interfaces I encountered. I wasn't impressed.

A few stood out, but most screens were an array of boxes and numbers for inputting or displaying data. Many of these machines were large, and their complexity would require significant training to operate effectively. In most cases, the operator interface contributed little to reduce this complexity and make machine operation more intuitive. Some manufacturers used color to differentiate areas on the screen; others employed an almost monochrome look, even though they had a color monitor. In one booth it appeared as if each machine's HMI was designed by a different person who had no contact with any other controls engineer in the company. There was no continuity between any of the screens and one might even think the machines were built by different companies.

The challenges and difficulties that lead to poor screen design are understandable. Tight deadlines, last-minute program modifications and budget constraints all lead to compromises in the design. Customers often accept these compromises because they don't realize it can be better. Poor screen design is prevalent in custom equipment, but the same issues impact standard equipment screen design. When the time comes to update or redesign, an opportunity arises to make the design more intuitive and user-friendly. However, even if adequate time and energy is invested in an operator interface for a next-generation product, the tendency is to follow the format of the previous machine. After all, that format worked sufficiently well for the previous generation and everyone in the company understands how it works.

Customers often accept these compromises because they don't realize it can be better.

As controls engineers, we need to look at ourselves as designers as well as engineers. Anybody can put a numeric entry field on a screen to edit the value of a newly created timer. However, it takes planning and creativity to put that timer value on a screen where the operator expects to find it and can understand its effect on the process.

Screen design can be improved in a number of ways. One is to hire a design firm to evaluate your current design and create something new. This can be costly but will yield some fresh ideas. It's also challenging because it's difficult to convey all the details of the machine control to the designer. The greatest benefit will come from explaining your product to another designer and being forced to think about the control screens in a new way.

A less-costly idea might be to take some cues from the Internet or consumer electronics. Everyone has visited clean, well-designed websites and poor, disorganized websites. I see both extremes in the vendor sites that I regularly use to find product information or download software. Study the good sites, and think about what makes them easy to navigate and why the information is always right where you'd expect to find it.

Phones and GPSs are good examples, too. Most cell-phone users can pick up any phone and know how to use it without reading the user manual. The cell phone menu format is common to us, and we recognize icons that represent different functions. The same menus and icons can be applied to industrial machinery. If a machine control screen looks and functions similarly to an iPhone application or a Garmin GPS that the operator already has used, then that person will have an easier time understanding the machine controls.

I've applied what I've learned from these methods to our products at Extol. We've received positive feedback from our customers regarding the ease of use of the HMI on our Rapid Conductor hot plate welder and Vortex spin welder. Our next-generation InfraStake controller will be released soon and the screen design has received significant attention. I am excited to see the reaction to this product when it hits the market.

As you begin to apply industrial design to HMI screen design, you will be bothered by things that you never noticed before, and the changes that result will make the HMI easy to use and understand. Suddenly the HMI will become more than just a box for data entry but a way for operators to easily understand and control their machines. CD

Rob Bouws is a product development engineer at Extol (www.extolinc.com), a designer and builder of custom assembly equipment and automated systems in Zeeland, Mich.

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